

1. Reduction of classical mechanics to QM.  
Correspondence relations  
— diachronic, synchronic

Limiting relations for wave equation  
show (1)

2. Metaphysical reduction.  
Reduction of electrodynamics to electrodynamics  
show (2)

3. Part-whole reductions.  
case of classical atomic physics  
show (3)  
(always implies Cartesian product  
for combined phase space).

4. Quantum Entanglement and Quantum Holism.  
Entangled states and the  
alternative interpretation.  
show (4)

Hidden Variables : show (5) and (6)

Stochastic h-v  
theories : show (7) and (8)

Penetration-at-a-distance show (9)

1. Limiting relations
2. Reduction of electrostatics to electrodynamics
3. Part-whole reduction (curved phase space)
4. Quantum Entanglement
5. Heywood - Bell's theorem
6. <sup>causal</sup>  
(Feynman, VR, OLC, ELOC)
7. Stochastic hidden - variable Theories
8. Outcome - dependence & parameter dependence
9. Causality, outcome dependence, robustness and power at a distance.



Introduction In my opinion it is biologists  
and maybe chemists (like Peter Atkins) who  
are deepest in the wool reductionists, in  
a crude sense that would have applied  
to the 18th C. Enlightenment. They took  
to physics as the firm universal  
bedrock for the hierarchical reductionist  
tower of knowledge. But for  
physicists, at any rate some physicists,  
this foundation is itself shifting  
sand, fraught even with paradox,  
and quite unsuited to support the  
towering edifice above it. I want  
to look at some of these foundations  
and show in what precise sense they  
actually serve to undermine reductionism.

I will not be appealing to lovely  
arguments ~~about~~ of philosophy,  
or the useful theory, but to  
the hard, critical, rational examination  
of the evidence, that Peter Atkins so  
eloquently recommended to us this  
morning.

But first I want to look at the problem  
of reduction in a wider setting, and  
before concentrating on the part-whole  
reductions that are probably the major  
interest of this conference.